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| Fiscal Year: | FY 2018 | Task Last Updated: | FY 05/24/2018 |
| PI Name: | Smith, Scott M Ph.D. | | |
| Project Title: | Space Biochemistry Profile | | |
| Division Name: | Human Research | | |
| Program/Discipline: | HUMAN RESEARCH | | |
| Program/Discipline--Element/Subdiscipline: | HUMAN RESEARCH--Biomedical countermeasures | | |
| Joint Agency Name: | TechPort: | No | |
| Human Research Program Elements: | (1) HHC :Human Health Countermeasures | | |
| Human Research Program Risks: | (1) Bone Fracture :Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (2) Food and Nutrition :Risk of Performance Decrement and Crew Illness Due to Inadequate Food and Nutrition (3) Immune :Risk of In Mission Impacts, Adverse Health Events or Long-Term Health Impacts due to Altered Immune Response (4) Nutrition :Risk of Inadequate Nutrition (5) Osteo :Risk Of Early Onset Osteoporosis Due To Spaceflight (6) Renal Stone :Risk of Renal Stone Formation | | |
| Space Biology Element: | None | | |
| Space Biology Cross-Element Discipline: | None | | |
| Space Biology Special Category: | None | | |
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| Organization Name: | NASA Johnson Space Center | | |
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| Zip Code: | 77058-3607 | Congressional District: | 36 |
| Comments: | | | |
| Project Type: | Flight | Solicitation / Funding Source: | 2012 Crew Health NNJ12ZSA002N |
| Start Date: | 08/01/2013 | End Date: | 12/31/2019 |
| No. of Post Docs: | No. of PhD Degrees: | | |
| No. of PhD Candidates: | No. of Master' Degrees: | | |
| No. of Master's Candidates: | No. of Bachelor's Degrees: | | |
| No. of Bachelor's Candidates: | Monitoring Center: NASA JSC | | |
| Contact Monitor: | Norsk, Peter | Contact Phone: | |
| Contact Email: | Peter.norsk@nasa.gov | | |
| Flight Program: | ISS | | |
| Flight Assignment: | ISS NOTE: End date changed to 12/31/2019 per PI (Ed., 6/5/18) | | |
| Key Personnel Changes/Previous PI: | | | |
| COI Name (Institution): | Zwart, Sara Ph.D. (Universities Space Research Association) Heer, Martina Ph.D. (University of Bonn) | | |
| Grant/Contract No.: | Internal Project | | |
| Performance Goal No.: | | | |
| Performance Goal Text: | | | |

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| Task Description: | As long-duration spaceflights continue and the operational suite of countermeasures is modified, the food system is updated, and the duration of missions lengthens, it will be important to evaluate and monitor a broad set of biomarkers for key physiological systems. The Nutritional Status Assessment Supplemental Medical Objective (aka "Nutrition SMO") was initiated in 2006, and has yielded significant clinical, operational, and research data. This proposal aims to extend the Nutrition SMO, under the guidelines provided in the NRA (NASA Research Announcement). Nutrition SMO data have been used to help identify or explain medical, scientific, and even engineering issues that have occurred during or after International Space Station (ISS) missions. The data have been used by Medical Operations on multiple occasions, to confirm the effectiveness of vitamin D supplementation, to test for nutrient toxicities (secondary to supplement use), to evaluate blood and urine chemistries after instances of kidney stones and gout symptoms in crewmembers, and to evaluate the effects of using a new exercise device on bone and calcium metabolism. The ISS Program Office has used these data to determine factors contributing to the Urine Processor Assembly failure and to make forward operational decisions. Perhaps most striking, the data provided evidence that one-carbon metabolism may be altered in crewmembers who experienced vision changes post flight, the highest Human Research Program risk. The relationship between nutritional status and 1-carbon metabolism would likely never have been discovered if the Nutrition SMO were not being conducted. The impact of the data collected to date provides a strong rationale for continuing with an updated version of this protocol, eliminating some tests while expanding others, to provide a repository of data to other scientific Disciplines. We have extensive experience with these types of analyses, sample and data management, transfer to data archives, and data reduction for medical, management, and research purposes. |
| Rationale for HRP Directed Research: | |
| Research Impact/Earth Benefits: | The findings from this study will help us better understand physiological adaptation to spaceflight, and will help evaluate countermeasure effectiveness. These results help the ISS Program, the Human Research Program (HRP), Space Medicine, Office of the Chief Health and Medical Officer (OCHMO), individual astronauts, and other experiments. These results will also inform the general, medical, and scientific communities on human health and physiological issues in an altered gravity environment. There could be significant potential implications of these findings. |
| Task Progress: | Study continues nominally with crews collecting samples, SpaceX sample returns, and subsequent analyses. Last participating crewmember will launch in 2018. Data continue to have value for the ISS Program, HRP, OCHMO, Space Medicine, other investigations, and to individual astronauts. |
| Bibliography Type: | Description: (Last Updated: 05/15/2025) |
| Abstracts for Journals and Proceedings | Smith SM, Heer M, Zwart SR. "B-vitamin status on International Space Station (ISS) Missions." Nutrition 2018 Conference, Boston, MA, June 9-12, 2018. Nutrition 2018 Conference, Boston, MA, June 9-12, 2018. , Jun-2018 |
| Articles in Peer-reviewed Journals | Heacox HN, Gillman PL, Zwart SR, Smith SM. "Excretion of zinc and copper increases in men during 3 weeks of bed rest, with or without artificial gravity." J Nutr. 2017 Jun;147(6):1113-20. https://doi.org/10.3945/jn.117.247437 ; PMID: 28490676; PMCID: PMC5443469 , Jun-2017 |
| Books/Book Chapters | Zwart SR, Smith SM. "Nutrition and Metabolism." in "Encyclopedia of Bioastronautics." Ed. L. Young, J. Sutton. Cham: Springer, 2018. https://doi.org/10.1007/978-3-319-10152-1_53-2 , May-2018 |
| Books/Book Chapters | Lane HW, Smith SM, Kloeris VL. "Metabolism and nutrition." in "Space physiology and medicine: From evidence to practice." Ed. A. Nicogossian, et al. New York: Springer, 2016. p. 307-21. https://doi.org/10.1007/978-1-4939-6652-3_11 , Dec-2016 |